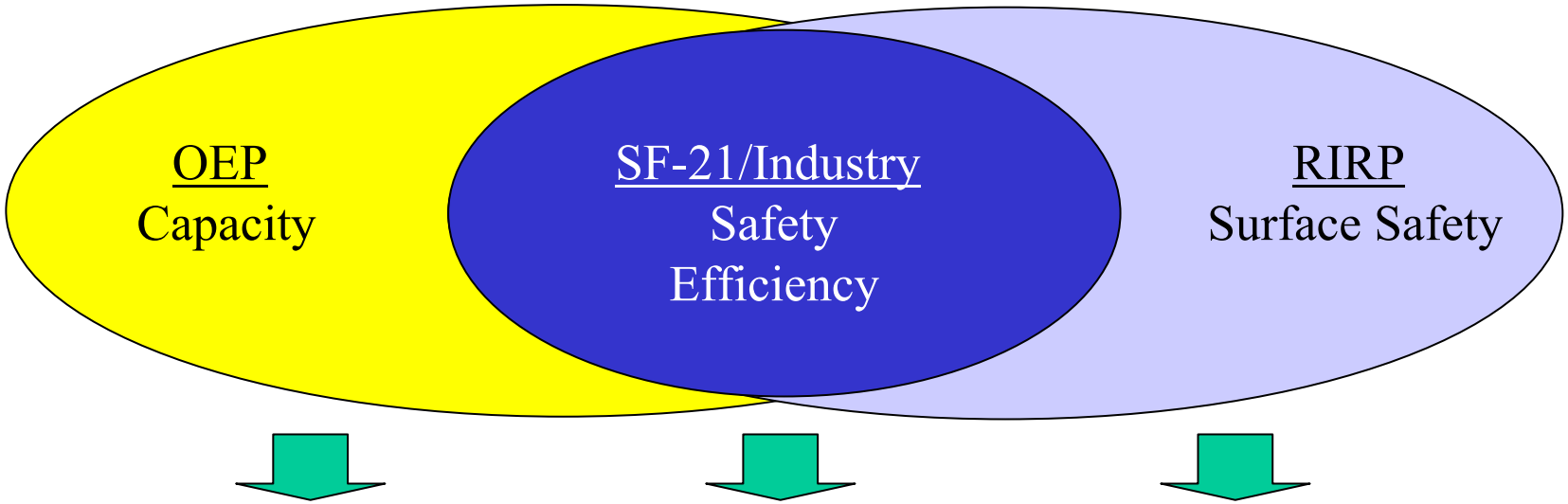
CNS Panel Discussion

Safe Flight 21 and Surface Technology Roadmap

May 2001

AND-500 Portfolios

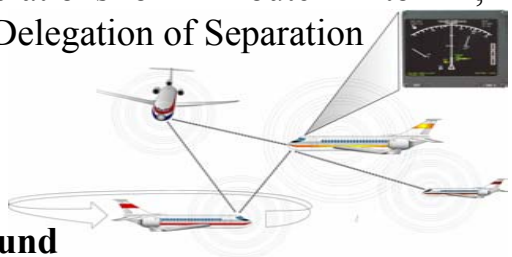


Stakeholders:	FAA Associates	RTCA/FF/Capstone Industry Council	Runway Safety Program
Direction/ Strategies:	Causal Factor Study OEP Plan Capstone Program Plan SF-21 Master Plan		Avionics Evolution Plan Standards Evolution Plan Surface Technology Roadmap

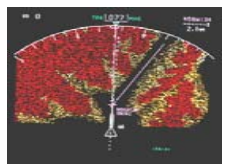
Safe Flight 21 Program Overview

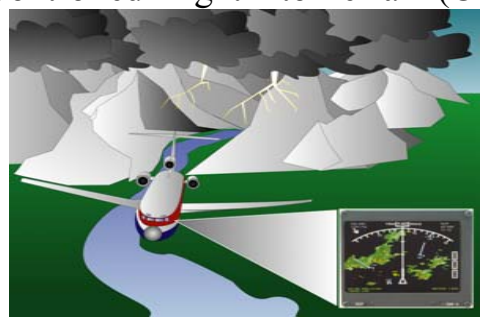
- Objective:
  - Expedite emerging technology
  - Government and industry cooperation
  - Demonstrate 9 enhancements that will facilitate free flight capability

Air-to-Air
- Improved Separation Standards
- Improved Low-Visibility Approaches
- Enhanced See and Avoid
- Enhanced Operations for En Route Air-to-Air, Investigating Delegation of Separation Authority

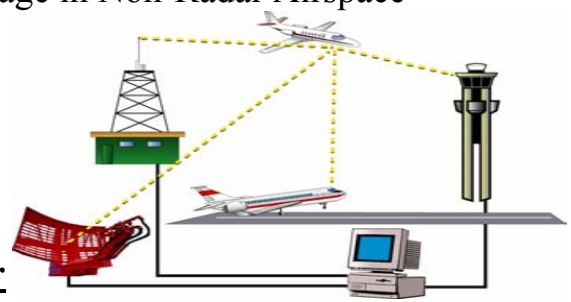


Air-to-Ground
- Affordable Reduction of Controlled Flight into Terrain (CFIT)

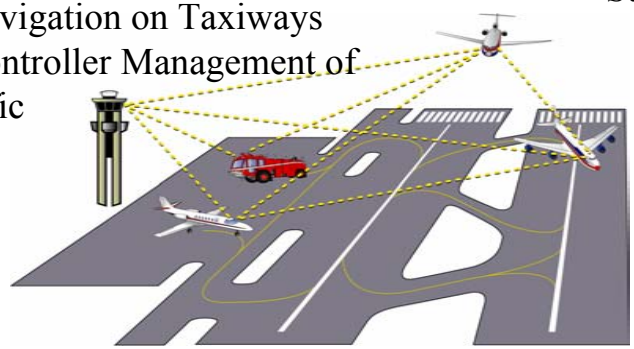




Air-to-Ground
- Surveillance Coverage in Non-Radar Airspace



Ground-to-Ground
- Improved Navigation on Taxiways
- Enhanced Controller Management of Surface Traffic



Ground-to-Air
- Weather and Other Data to the Cockpit

Safe Flight 21Program

Safe Flight 21

- Surface technology demonstrations in Ohio River Valley
  - Test beds established in Memphis and Louisville
  - Improved surface surveillance and navigation for the pilot/controller
    - Multilateration and data fusion
    - ADS-B and TIS-B
    - Surface moving map
- Alaska Capstone:
  - Bethel:
    - Objective: Provide ADS-B radar-like services in remote Yukon-Kuskokwim Delta area (where no radar coverage exists) to reduce accidents (Initial operating capability January 1, 2001)
  - Capabilities:
    - Automatic Dependent Surveillance-Broadcast (ADS-B) (for non-radar coverage areas)
    - Flight Information Services (FIS)
    - Controlled Flight Into Terrain (CFIT)

Refocus Application Approach

- Safe Flight 21 “checklist” team currently focused on development of 4 specific checklist
  - 6.1.1 FAROA
  - 3.2.1 Approach spacing
  - 3.4 Departure spacing
  - 6.2 Surface situational Awareness
- Reality is that we can not afford to do applications in “serial” fashion
- Must think of applications from a more “holistic” end-to-end approach
  - **Refocusing accomplishes this approach**

Surface Applications

OEP

- AD-6 Surface Movement Coordination
- AD-7 Arrival / Departure Throughput:Airport Surface Movement

Common Threads

- Shared Situational Awareness for all participants
  - ATC Tower
  - Airline AOC
  - Cockpit
  - Vehicle
- Surface Management System feed by high update rate data
- Robust Surface Navigation capability to pilot through use of CDTI
  - Ownership position
  - Ownership w/other targets via TIS-B/ADS-B
  - Blind Taxi

SF-21

- 6.1.1 Runway and Final Approach Occupancy Awareness (ADS-B only)
- 6.1.2 Runway and Final Approach Occupancy Awareness (ADS-B and TIS-B)
- 6.2 Airport Surface Situational Awareness
- 7.1 ASDE Enhancement with ADS-B
- 7.2 Surveillance coverage at Airports w/out ASDE
- XX Surface Management System(SMS)

Surface Capabilities

Phase 1

- ATC Tower (7.1)
  - Color display
  - Target info w/ data tag
- Surface moving map (6.1.1, 6.1.2, 6.2)
  - Both aircraft + vehicles
  - Target info provided via ADS-B / TIS-B
  - Both surface + final approach segment
- Surface management
  - "Real time" feed of data to AOC's

Phase 2

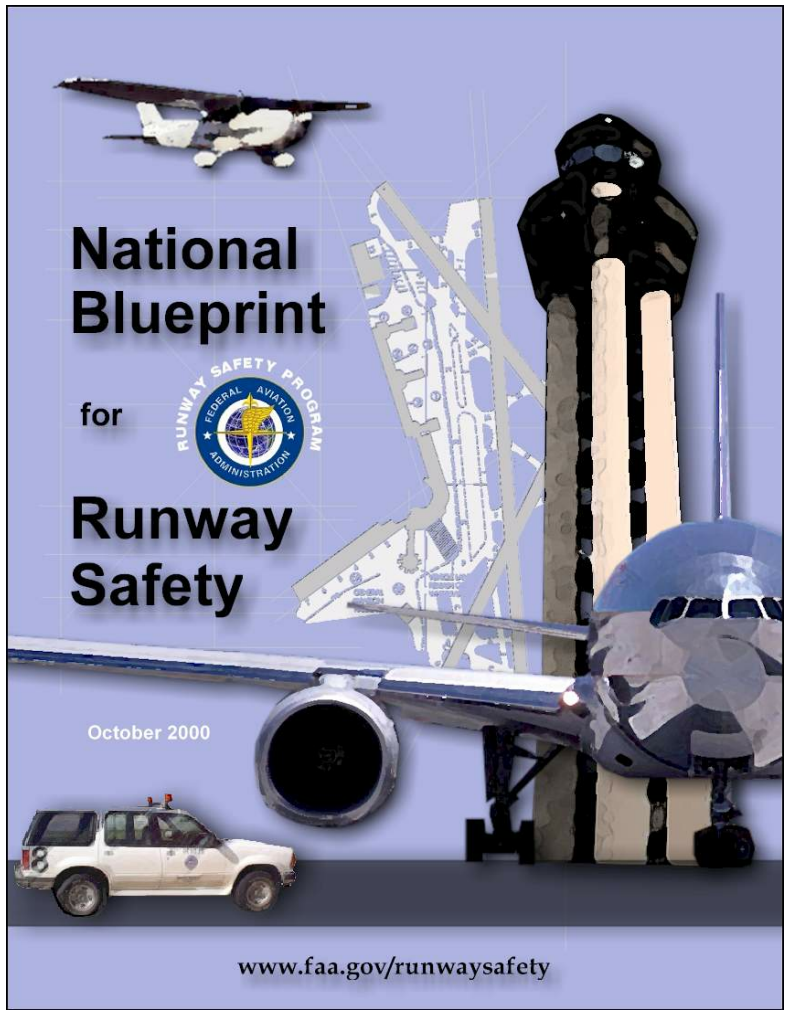
- ATC Tower
  - Alerting
- Surface moving map
  - Alerting
  - Graphical notam overlay
- Surface management
  - AOC Decision support tools
  - Collaborative decision support tools between AOC's

Phase 3

- ATC Tower
  - Taxi conformance monitoring
- Surface moving map
  - Taxi conformance monitoring
  - Blind taxi capability
- Surface management
  - Collaborative Decision support tools between AOC's and ATC

Runway Safety Program

- Blueprint Safety Initiatives
  - Seven major thrusts:
    - Training
    - Technology
    - Communications
    - Procedures
    - Airport Signs, Markings, and Lighting
    - Data Analysis and Metrics
    - Local Solutions



Human Factors touches all initiatives

Surface Technology Assessment

- Runway Incursion Reduction Program (RIRP)
  - Programs:
    - Existing technologies
      - » Runway Status Lights (RWSL)
      - » Loop technology (LOT) (Long Beach)
      - » Multilateration (Long Beach)
      - » Dallas/Ft. Worth RIRP Test Bed
    - Emerging technologies
      - » Surface Technology Broad Agency Announcement

Technology/Product	Contractor	Demonstration Schedule	Site
Multilateration/IR Sensor Fusion	Sensis and Tri-Space	July-August 2001	Memphis
Magnetic Sensors	Honeywell	July-August 2002	Minneapolis
GPS/RF Data Link Vehicle Tracking	Veridian Engineering	November 2001	Warminster, PA
Beacon Marker Voice Messages	Ericcson	September 2001	WJHTC
Addressable Signs	Technology Planning Inc.	November 2001	Litton-Denro Gaithersburg, MD

Runway Safety Program (cont'd)

- Runway incursions result from three types of surface incidents:
  - Operational Errors (OE)
  - Pilot Deviations (PD)
  - Vehicle/Pedestrian Deviations (V/PD)
- Runway incursion data

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
281	242	219	186	200	240	275	292	325	321	429

- CY 2000 breakdown:
  - Pilot Deviations 59%
  - Operational Errors 21%
  - Vehicle/Pedestrian 20%

*97 Total Incursions January - March 2001

Cockpit Surface Moving Map Technology Roadmap

Phase 1

- Capability
  - » Basic surface moving map

- Solves **43%**
  - **18%** » Pilot unfamiliarity with airport
  - **7%** » Monitor of progressive taxi (basic)
  - **7%** » Establish aircraft position on surface
  - **11%** » Memory aid to help remember ATC instructions (basic)

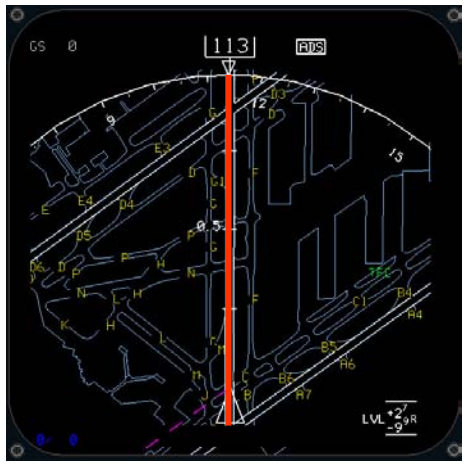
Phase 2

- Capability
  - » Phase 1
  - » Target reports (requires ADS-B / TIS-B)

- Solves
  - » Phase 1
  - » Aid to visual scan prior to takeoff/ landing
  - » Runway occupancy (basic)

Phase 3

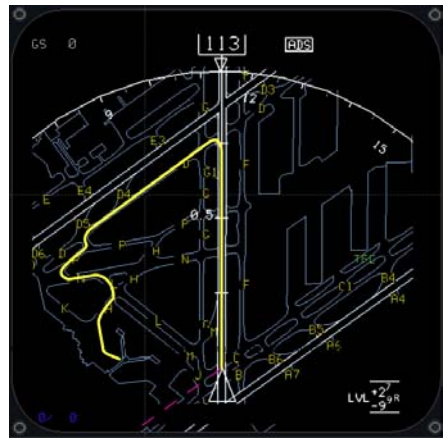
- Capability
  - » Phase 1 and 2
  - » Alerting (requires common alerting scheme with ATC



- Solves
  - » Phase 1 and 2
  - » Runway occupancy (advanced)
  - » Use of alerting to focus pilot attention to critical situations

Phase 4

- Capability
  - » Phase 1, 2 and 3
  - » Data link of taxi instructions (requires CDPLC in CY05)



- Solves
  - » Phase 1, 2 and 3
  - » Memory aid to help pilot remember ATC instruction (advanced)
  - » Pilot communications (complexity, confirmation of ATC taxi instructions)

Integrated Architecture "Large/Medium Airport"